

Department of Environmental Quality
Division of INL Oversight
and Radiation Control

ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT

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Table of Acronyms

aCi/L	-	attocuries per liter	MDC	-	minimum detectable concentration
BEA	-	Battelle Energy Alliance, LLC	NIST	-	National Institute of Standards and Technology
CERCLA	-	Comprehensive Environmental Response Compensation and Liability Act	nCi/L	-	nanocuries per liter
CFA	-	Central Facilities Area	NOAA	-	National Oceanic and Atmospheric Administration
CWI	-	CH2M-WG Idaho, LLC	NRF	-	Naval Reactors Facility
DEQ-INL	-	The State of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control	pCi/L	-	picocuries per liter
DOE	-	U.S. Department of Energy	pCi/m ³	-	picocuries per cubic meter
EIC	-	electret ionization chamber	PM ₁₀	-	particulate matter with aerodynamic diameter less than or equal to 10 micrometers
EML	-	Environmental Monitoring Laboratory	PCE	-	perchloroethene
EPA	-	Environmental Protection Agency	QAPP	-	Quality Assurance Program Plan
ESER	-	Environmental Surveillance Education and Research Program (SM Stoller)	QA/QC	-	Quality Assurance/Quality Control
ESP	-	Environmental Surveillance Program	RCRA	-	Resource Conservation and Recovery Act
ESRPA	-	Eastern Snake River Plain Aquifer	RPD	-	relative percent difference
HPIC	-	high-pressure ion chamber	RWMC	-	Radioactive Waste Management Complex
LLD	-	lower limit of detection	RTC	-	Reactor Technology Complex
IBL	-	Idaho Bureau of Laboratories	SD	-	standard deviation
INL	-	Idaho National Laboratory	SMCL	-	secondary maximum contaminant level
INTEC	-	Idaho Nuclear Technology and Engineering Center	TAN	-	Test Area North
LSC	-	liquid scintillation counting	TCE	-	trichloroethene
MFC	-	Materials and Fuels Complex	TDS	-	total dissolved solids
µg/L	-	micrograms per liter	TMI	-	Three Mile Island
mg/L	-	milligrams per liter	TSP	-	total suspended particulate
mrem	-	millirem or 1/1000 th of a rem	TSS	-	total suspended solids
mR/hr	-	milliRoentgen per hour	USGS	-	U.S. Geological Survey
µR/hr	-	microRoentgen per hour	VOC	-	volatile organic compound
MCL	-	maximum contaminate level	WLAP	-	Wastewater Land Application Permit
MDA	-	minimum detectable activity			

Introduction

The state of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control (DEQ-INL) Environmental Surveillance Program (ESP) is conducted at locations on the INL, on the boundaries of the INL, and at distant locations to the INL in accordance with accepted monitoring procedures and management practices. This program is designed to provide the people of the state of Idaho with independently evaluated information about the impacts of the Department of Energy's (DOE) activities in Idaho.

The primary objective for DEQ-INL's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's data and programs. This program is also used to provide the citizens of Idaho with information that has been independently evaluated to enable them to reach informed conclusions about DOE activities in Idaho and potential impacts to public health and the environment.

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a more broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to provide the mechanism to document the results of the ESP on a quarterly basis and provide detailed data to those who wish to "see the numbers." It is organized according to the media sampled and also provides a quality assurance assessment.

Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INL as well as two monitoring stations distant from the INL during the fourth quarter, 2005 (**Figure 1**). These stations employed instrumentation for collecting airborne particulate matter, gaseous radioiodine, precipitation, and water vapor for tritium analysis (**Table 1**). The Shoshone-Bannock Tribes operated an air monitoring station located at Fort Hall. The Fort Hall station uses identical instrumentation and sampling protocol as the ten stations operated by the ESP. The DEQ-INL reports the Fort Hall station data as an additional background site.

Airborne particulate matter was sampled using a high-volume total suspended particulate (TSP) air sampler. Weekly gross alpha and gross beta particulate radioactivity results for filters from the TSP samplers are presented in **Appendix A** and summarized in **Table 2**. Gross alpha and gross beta radioactivity concentrations reported from the particulate samples were within the range of expected values for naturally occurring radioactivity observed historically.

Composites of filters collected using TSP samplers during the course of a calendar quarter were analyzed using gamma spectroscopy. Typically, gamma spectroscopy results were only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectroscopy results for the fourth quarter of 2005 for TSP filters are presented in **Table 3**. The only reported gamma-emitting radionuclide was beryllium-7, a naturally occurring, cosmogenic radionuclide.

No radioactive isotopes of iodine, specifically iodine-131, were detected on the weekly charcoal cartridges used to collect this nuclide during the fourth quarter.

Atmospheric moisture was collected by drawing air through hygroscopic media at each of the eleven monitoring stations. This moisture was stripped from the hygroscopic media and analyzed to calculate the atmospheric tritium concentration. Reported values are the result of either a single sample or a

weighted mean based upon the volume of air sampled when more than one atmospheric moisture sample was collected during the calendar quarter. Atmospheric tritium was detected at the Experimental Field Station during the fourth quarter of 2005. The detected tritium levels were less than 1 percent of the action levels established by DEQ-INL. The TMI-2 fuel currently stored at INTEC is the likely source for the atmospheric tritium observed at this location. Additionally, the Howe station detected tritium levels at or slightly above the MDA. The detected tritium levels at this location were also much less than 1 percent of the action levels established by DEQ-INL. No additional atmospheric tritium was measured at offsite locations during the fourth quarter of 2005. Average atmospheric tritium concentrations are presented in **Table 4**.

Precipitation samples were collected at six monitoring locations during the fourth quarter of 2005.

Precipitation samples were analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the fourth quarter of 2005. Tritium and cesium-137 analysis results are presented in **Table 5**. Reported values were either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter.

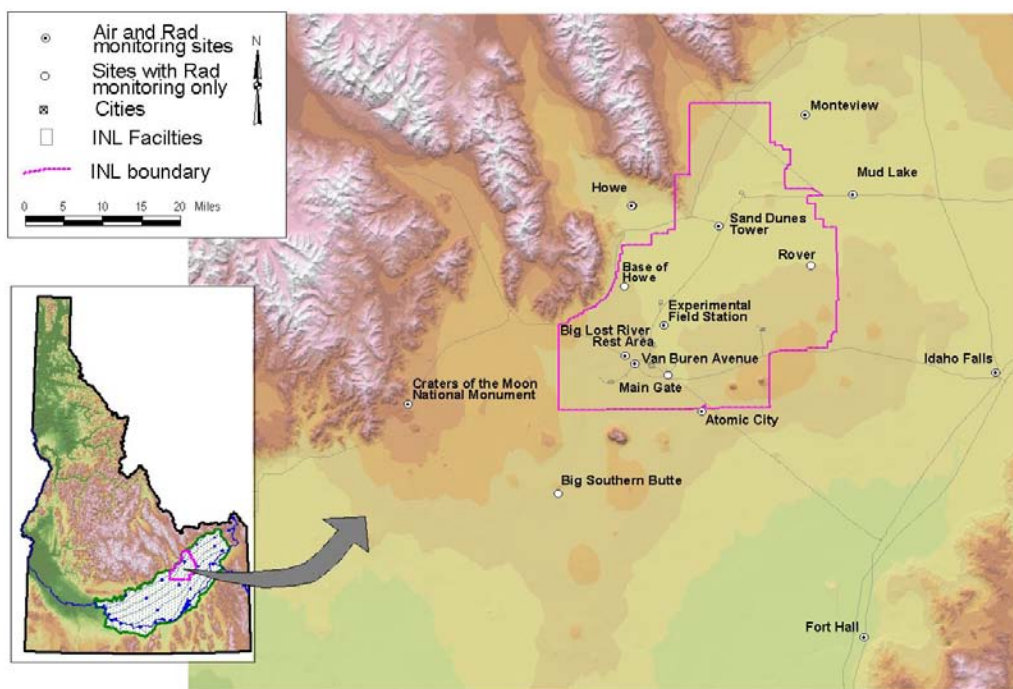


Figure 1. Air and radiation monitoring sites.

Table 1. Sampling locations and sample type.

Station Locations	Sample type ¹			
	TSP	Radioiodine	Water Vapor	Precipitation
On-site Locations				
Big Lost River Rest Area	□	□	■	■
Experimental Field Station	□	□	■	
Sand Dunes Tower	□	□	■	
Van Buren Avenue	□	□	■	
Boundary Locations				
Atomic City	□	□	■	■
Howe	□	□	■	■
Montevue	□	□	■	■
Mud Lake	□	□	■	■
Distant Locations				
Craters of the Moon	□	□	■	
Fort Hall ²	□	□	■	
Idaho Falls	□	□	■	■
¹ □ Samples collected weekly; ■ Samples collected quarterly. ² TSP and radioiodine samples collected by Shoshone-Bannock Tribes.				

Table 2. Range of alpha and beta concentrations for TSP filters, fourth quarter, 2005. Concentrations are reported in 1×10^{-3} pCi/m³.

Station Location	Concentration					
	Gross Alpha			Gross Beta		
On-Site Locations						
Big Lost River Rest Area	0.2	-	1.6	16.1	-	74.4
Experimental Field Station	0.1	-	1.7	15.5	-	89.4
Sand Dunes Tower	0.4	-	1.8	16.0	-	97.8
Van Buren Avenue	0.3	-	1.5	17.9	-	83.6
Boundary Locations						
Atomic City	0.1	-	1.0	17.4	-	96.1
Howe	0.3	-	1.3	14.0	-	74.2
Montevue	0.4	-	2.1	16.4	-	83.2
Mud Lake	0.5	-	2.3	14.9	-	95.2
Distant Locations						
Craters of the Moon	0.2	-	1.3	9.7	-	50.3
Fort Hall ¹	0.7	-	2.2	11.9	-	56.4
Idaho Falls	0.2	-	1.8	14.6	-	66.7
¹ Operated by Shoshone-Bannock Tribes.						

Table 3. Gamma spectroscopy analysis data of TSP filters, composite sample, fourth quarter, 2005. Concentrations are reported in 1×10^{-3} pCi/m³ with associated uncertainty (± 2 SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar quarter.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
On-site Locations			
Big Lost River Rest Area	67.6	3.8	<MDC
Experimental Field Station	67.7	3.8	<MDC
Sand Dunes Tower	57.8	3.2	<MDC
Van Buren Avenue	61.5	3.5	<MDC
Boundary Locations			
Atomic City	76.4	4.3	<MDC
Howe	61.8	3.5	<MDC
Montevieu	58.0	3.2	<MDC
Mud Lake	57.3	3.2	<MDC
Distant Locations			
Craters of the Moon	62.4	3.5	<MDC
Fort Hall ¹	58.6	3.4	<MDC
Idaho Falls	64.6	3.5	<MDC
¹ Operated by Shoshone-Bannock Tribes.			

Table 4. Tritium concentrations from atmospheric moisture, fourth quarter, 2005. Concentrations are reported in pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium		
	Concentration	± 2 SD	MDC
On-site Locations			
Big Lost River Rest Area	0.21	0.17	0.27
Experimental Field Station	1.13 ¹	0.21	0.30
Sand Dunes Tower	0.26	0.19	0.32
Van Buren Avenue	-0.08	0.0	-0.12
Boundary Locations			
Atomic City	0.11	0.20	0.33
Howe	0.39 ¹	0.22	0.35
Mud Lake	-0.06	0.24	0.42
Montevieu	0.13	0.19	0.32
Distant Locations			
Craters of the Moon	0.00	0.22	0.38
Fort Hall	-0.13	0.29	0.50
Idaho Falls	-0.03	0.20	0.35
¹ The reported concentrations exceed the MDC.			

Table 5. Tritium and cesium-137 concentrations from precipitation, fourth quarter, 2005. Concentrations are reported in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Station Location	Tritium			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
On-site Locations						
Big Lost River Rest Area	-70	70	130	-1.3	1.4	2.6
Boundary Locations						
Atomic City	0	80	130	0.6	1.4	2.3
Howe	-20	80	130	1.5	2.0	3.3
Montevue	20	80	130	0.6	2.0	3.5
Mud Lake	30	80	130	-0.3	1.5	2.6
Distant Locations						
Idaho Falls	-20	80	130	0.3	1.6	2.7

Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the fourth quarter of 2005 (**Figure 1**). To detect gamma radiation, each station is instrumented with an electret ionization chamber (EIC), and 11 of the stations also have high-pressure ion chambers (HPIC) (**Table 6**). The Shoshone-Bannock Tribes operate an additional environmental radiation station at Fort Hall equipped with both an EIC and HPIC. The DEQ-INL reports these results.

HPICs are instruments capable of real-time measurements, and are sensitive enough to detect small changes in gamma radiation levels. The real-time gamma radiation measurements collected by the HPICs at each location are radioed to DEQ-INL and presented graphically via the worldwide web at www.idahoop.org. EICs are a passive-integrating system that provides a cumulative measure of environmental gamma radiation exposure in the field. Typically, EICs are deployed, collected and analyzed quarterly. DEQ-INL compared the exposure rates measured by EICs and HPICs and observed that the data correlated very well from both measurement methods; although, EICs tend to over respond by approximately 20 percent, accounting for the slight differences observed between the two measurements. A complete analysis of the radiation measuring devices can be found in *A Comparison of Three Methods for Measuring Environmental Radiation*, Moser, Kristi, Idaho State University, M.S. Thesis, 2002. Each system is used by DEQ-INL to measure gamma radiation for various radiological monitoring objectives. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. It is because of this reason that EICs are also deployed at 78 locations by DEQ-INL in a widespread network around the INL measuring general background radiation. This information is tabulated in **Appendix B**.

Table 7 lists the average radiation exposure rates measured by the HPICs for fourth quarter. Exposure rates were within the expected historical range of values observed by DEQ-INL for background radiation. **Table 8** lists the EIC monitoring results for fourth quarter.

Table 6. Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	HPIC	EIC
On-site Locations		
Base of Howe	■	■
Big Lost River Rest Area	■	■
Experimental Field Station		■
Main Gate	■	■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
Boundary Locations		
Atomic City	■	■
Big Southern Butte	■	■
Howe	■	■
Monteview	■	■
Mud Lake	■	■
Distant Locations		
Craters of the Moon		■
Fort Hall ¹	■	■
Idaho Falls	■	■
¹ HPIC operated by Shoshone-Bannock Tribes with the EIC maintained by DEQ-INL.		

Table 7. Average gamma exposure rates for fourth quarter, 2005, from HPIC network. These rates are expressed in $\mu\text{R/hr}$.

	Exposure Rate	
	Quarterly Average	$\pm 2 \text{ SD}$
On-site Locations		
Base of Howe	12.8	1.1
Big Lost River Rest Area	14.1	1.4
Main Gate	14.3	1.0
Rover	14.2	1.1
Sand Dunes Tower	16.1	2.1
Boundary Locations		
Atomic City	13.6	1.1
Big Southern Butte	13.8	1.1
Howe	12.8	1.3
Monteview	12.2	0.9
Mud Lake	12.2	1.0
Distant Locations		
Fort Hall ¹	12.6	1.2
Idaho Falls	11.8	0.9
¹ Operated by Shoshone-Bannock Tribes.		

Table 8. Electret ionization chamber (EIC) cumulative average exposure rates for fourth quarter, 2005. These rates are expressed in $\mu\text{R/hr}$.

Station Location	Exposure Rate	
	Total	$\pm 2 \text{ SD}$
On-site Locations		
Base of Howe	16.8	1.5
Big Lost River Rest Area	21.5	2.0
Experimental Field Station	24.4	0.9
Main Gate	22.0	4.4
Rover	16.4	3.7
Sand Dunes Tower	20.6	3.8
Van Buren Avenue	21.4	2.0
Boundary Locations		
Atomic City	21.4	3.0
Big Southern Butte	17.4	1.2
Howe	17.0	0.6
Monteview	23.2	4.0
Mud Lake	19.4	2.2
Distant Locations		
Craters of the Moon	19.0	3.6
Fort Hall	20.3	5.3
Idaho Falls	17.8	3.5

Water Monitoring

Water monitoring sites are sampled for the purposes of examining trends of INL contaminants and other general ground water quality indicators and for verifying DOE monitoring results. Sites sampled include ground water locations (wells and springs), surface water locations (streams), and selected effluent sites. Sample sites have been selected to aid in identifying INL impacts on the Eastern Snake River Plain Aquifer (ESRPA), and are categorized as on-site, boundary, and distant (**Figures 2 and 3**). On-site locations are sample sites within the INL including wells near facilities in areas of known contamination, or wells selected to illustrate trends for specific INL contaminants or indicators of ground water quality. Selected surface water and effluent sites on the INL are monitored as current sources of recharge or impacts to the aquifer. Boundary locations include sample sites on the perimeter of the INL that provide background water quality data, are accessible to the public, or down gradient of potential sources of contamination. Distant locations are monitored to provide trends in water quality down gradient of the INL and include wells and springs used for irrigation, public water supply, livestock, domestic, and industrial purposes. During the fourth quarter of 2005, the DEQ-INL sampled 19 on-site locations (including 2 effluent sites), 5 boundary locations (including one surface water location) and 5 distant locations.

Many sites sampled by DEQ-INL are sampled with another agency or organization. Samples are collected at about the same time using the same collection equipment as the other agency or organization (co-sampled). DEQ-INL verifies work by these agencies monitoring on behalf of DOE by comparing results from co-sampled sites.

Gross alpha and gross beta analyses are conducted as a screening tool for alpha and beta emitting radionuclides potentially released due to INL operations. Selected sites are sampled for the man-made, beta emitting radionuclides technetium-99 and strontium-90, based on historic INL contamination. In the event of suspect or unexpected levels of gross radioactivity, additional samples may also be analyzed for other specific radionuclides.

Gross alpha radioactivity was detected in 12 of 19 on-site samples and ranged from 2.9 ± 1.9 to 10.4 ± 3.3 pCi/L, and in 3 of 5 boundary locations and ranged from 4.2 ± 1.9 to 5.0 ± 2.0 pCi/L. There were no detections in samples from the distant sites. The EPA maximum contaminant level (MCL) for alpha particles is 15 pCi/L. Gross beta radioactivity was detected in all but one on-site sample and ranged from 2.5 ± 1.1 to 220 ± 3.7 pCi/L. Gross beta was detected in all of the boundary (2.3 ± 0.9 to 3.6 ± 0.9 pCi/L) and distant samples (2.4 ± 1 to 8.1 ± 1.3 pCi/L). Background concentrations of gross beta radioactivity in the ESRPA range from 0 to 8 pCi/L as established in *Background Concentrations of Selected Radionuclides, Organic Compounds and Chemical Constituents in Groundwater in the Vicinity of the Idaho National Engineering Laboratory*, (Orr and others, 1991). The derived MCL for beta radioactivity is 8 pCi/L if the source of the radioactivity is strontium-90; 900 pCi/L if technetium-99; or 20,000 pCi/L if tritium. The concentrations of gross alpha and gross beta radioactivity were consistent with historical results and were within expected ranges. No man-made, gamma emitting radionuclides were identified via gamma spectroscopic analysis. Results for gross alpha, gross beta, and man-made, gamma emitting radioactivity are shown in **Table 9**.

Eleven on-site locations were sampled for strontium-90; three sites had detectable levels and ranged from 10.1 ± 2.4 to 96 ± 23 pCi/L. The concentrations are consistent with historical trends for the sites sampled. Results for strontium-90 are found in **Table 10**. One sample, NRF Industrial Waste Ditch, was qualified as an estimate because of a sample preservation error.

Ten on-site locations were sampled for technetium-99 this quarter, (**Table 11**). Samples from seven sites had detectable concentrations and ranged from 0.2 ± 0.1 to 9.4 ± 0.3 pCi/L. The concentrations are consistent with historical trends.

Three on-site locations were sampled for isotopes of uranium, plutonium, and americium. Results for uranium-234 and 238 exceeded detectable levels, and ranged from 0.85 ± 0.25 to 2.37 ± 0.52 pCi/L and 0.36 ± 0.15 to 1.32 ± 0.35 pCi/L respectively. There were no detections for the isotopes uranium-235; plutonium 235, 239/240, and 241; and americium-241 (**Tables 12-14**).

Samples for chlorine-36 were collected at two on-site locations, with results less than detectable levels. Samples were also collected from eight distant locations for chlorine-36 and iodine-129 during the previous quarter (**Tables 15-16**). These samples were analyzed by accelerator-mass spectroscopy (AMS). This special method of analysis allows for minimum detectable levels more than 6 orders of magnitude (one million times) lower than standard methods. Chlorine-36 results ranged from 46.4 ± 4 to 414 ± 46 aCi/L (1 aCi/L = 0.000001 pCi/L). Iodine-129 results ranged from 0.12 ± 0.033 to 1.24 ± 0.13 aCi/L. Chlorine-36 and iodine-129 are used as environmental indicators for wastes disposed of by the INL which may have leached into the aquifer. F. Hall, 2005, in *Concentrations of Selected Trace Metals, Common Ions, Nutrients and Radiological Analytes in Ground Water for Selected Sites, Eastern Snake River Plain Aquifer, South of the Idaho National Laboratory, Idaho*, included summarized results of sampling for chlorine-36 and iodine-129 for selected Eastern Snake River Plain Aquifer wells south of the INL boundary, and reported from other sources that concentrations greater than approximately 200 aCi/L chlorine-36 (equivalent to 1×10^8 atoms per liter chlorine-36) were indicative of anthropogenic impacts but not necessarily related to INL Operations, (i.e. radioactive fallout from weapons testing). Both Hall, 2005, and Cecil and others, 2003, in *Reevaluation of Background Iodine-129 Concentrations in Water*

from the Eastern Snake River Plain Aquifer, Idaho, reported concentrations ≥ 5.4 aCi/L (or about 1.4×10^8 atoms per liter iodine-129) were indicative of INL waste impacting the aquifer.

Using the standard analytical method, tritium was detected in 10 of 19 on-site samples (230 ± 90 to $16,400 \pm 340$ pCi/L), but detectable levels were not found in samples from boundary or distant locations (**Table 17**). Water samples with tritium concentrations not measurable using the standard method (typically a MDC of 130 pCi/L) are analyzed using an electrolytic enrichment method with a much lower MDC of 10 to 14 pCi/L (**Table 18**). Using the electrolytic enrichment method, tritium was detected in samples from one of two on-site locations (45 ± 9 pCi/L), two boundary sites (11 ± 7 to 41 ± 9 pCi/L) and four of five distant sites (13 ± 8 to 44 ± 8 pCi/L). Background concentrations of tritium in the ESRPA range from 0 to 40 pCi/L established in *Summary of Background Concentrations of Selected Radiochemical and Chemical Constituents in Ground Water from the Snake River Plain Aquifer, Idaho*, (Knobel and others, 1992). Enriched tritium samples for five locations were not analyzed in time for the third quarter report and are being reported here in the fourth quarter (15 ± 8 to 28 ± 8 pCi/L).

Water samples were also analyzed for metals and the results are shown in **Table 19**. The following discussion of metals results only applies to detectable concentrations. Distant locations were not sampled for metals, nutrients, or common ions this quarter. All results are within their expected ranges, depending on sample location and extent of contamination in specific areas. Barium results ranged from 20 to 270 $\mu\text{g/L}$ on-site locations, 65 to 3,000 $\mu\text{g/L}$ for effluent sites, and 32 to 62 $\mu\text{g/L}$ for boundary locations, while the MCL is 2,000 $\mu\text{g/L}$. Chromium results ranged from 5 to 110 $\mu\text{g/L}$ for on-site locations and 5 $\mu\text{g/L}$ for one effluent sample, while the MCL is 100 $\mu\text{g/L}$. Concentrations above approximately 5 $\mu\text{g/L}$ are indicative of INL contamination, based on historic DEQ-INL sample results. Iron results on-site ranged from 20 to 1,700 $\mu\text{g/L}$, while the Secondary Maximum Contaminant Level (SMCL) is 300 $\mu\text{g/L}$. Manganese results ranged from 4 to 530 $\mu\text{g/L}$ for on-site locations, from 30 to 300 for effluent sites and from 2 to 13 $\mu\text{g/L}$ for boundary locations, while the SMCL is 50 $\mu\text{g/L}$. Zinc results ranged from 10 to 610 $\mu\text{g/L}$ for on-site locations, 70 $\mu\text{g/L}$ for one effluent sample, and 60 $\mu\text{g/L}$ for one boundary location, and all were below the SMCL of 5,000 $\mu\text{g/L}$.

Common ions results are shown in **Table 20**. All results are within their expected ranges, depending on sample location and extent of contamination in specific areas. Calcium results ranged from 28 to 102 mg/L for on-site locations, 17 to 1,400 for effluent sites, and 38 to 45 mg/L for boundary locations. Magnesium results ranged from 11 to 26 mg/L for on-site locations, 3.5 to 450 mg/L for effluent sites, and 12 to 15 mg/L for boundary locations. Sodium results ranged from 8.3 to 57 mg/L for on-site locations, 400 to 11,500 mg/L for effluent sites and 5.4 to 17 mg/L for boundary locations. Potassium results ranged from 2.4 to 4.6 mg/L for on-site locations, 30 to 70 mg/L for effluent sites, and 1.0 to 3.0 mg/L for boundary locations. Fluoride results ranged from 0.276 to 0.817 mg/L for on-site locations, 0.58 mg/L for effluent sites, and 0.24 to 1.09 mg/L for boundary locations. Chloride results ranged from 4.24 to 60.1 mg/L for on-site locations, 197 to 21,000 mg/L for effluent sites, and 4.88 to 21.9 mg/L for boundary locations. Sulfate results ranged from 14.2 to 158 mg/L for on-site locations, 104 mg/L for effluent sites, and 21.7 to 23.9 mg/L for boundary locations. Results for alkalinity ranged from 93 to 272 mg/L for on-site locations, 212 to 525 mg/L for effluent sites, and 135 to 149 mg/L for boundary locations. Silica results ranged from 18 to 25 mg/L for on-site locations and 16.4 to 38.1 mg/L for effluent sites. Detectable results for total dissolved solids (TDS) ranged from 167 to 554 mg/L for on-site locations and 1200 to 29,000 mg/L for effluent sites. Total suspended solids (TSS) results ranged from 11 mg/L for on-site locations and 8 to 121 mg/L for effluent sites.

Nutrient results are presented in **Table 21**. Nitrite plus nitrate as nitrogen ranged from 0.007 to 16.5 mg/L for on-site locations, 0.026 to 0.187 mg/L for effluent sites, and 0.265 to 1.2 mg/L for boundary locations. Nitrogen concentrations more than 1-2 mg/L are indicative of anthropogenic (human-caused) contamination. There were no detectable ammonia results. There was one TKN result for an on-site

location (0.06 mg/L) and the effluent results ranged from 0.65 to 21 mg/L. Total phosphorus ranged from 0.011 to 0.3 mg/L for on-site, 1.27 to 7.44 mg/L for effluent, and 0.008 to 0.013 mg/L for boundary locations.

Volatile Organic Compounds (VOCs) with detectable concentrations are shown in **Table 22**. The background concentrations for VOCs should be zero. One sample from M1S near the Radioactive Waste Management Complex had detectable concentrations of two of the VOCs listed in **Appendix C**. However, this sample was not preserved correctly, so all results are qualified as estimates. Results are consistent with historical trends.

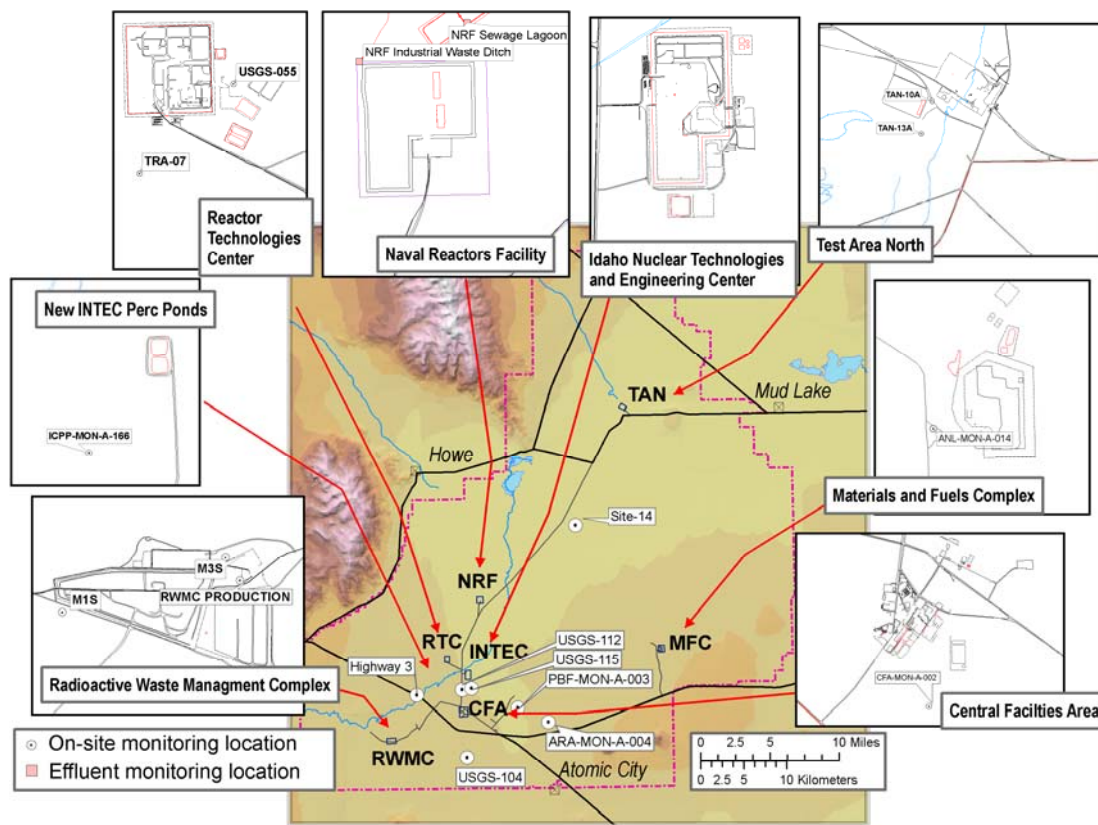


Figure 2. On-site water monitoring locations for fourth quarter, 2005.

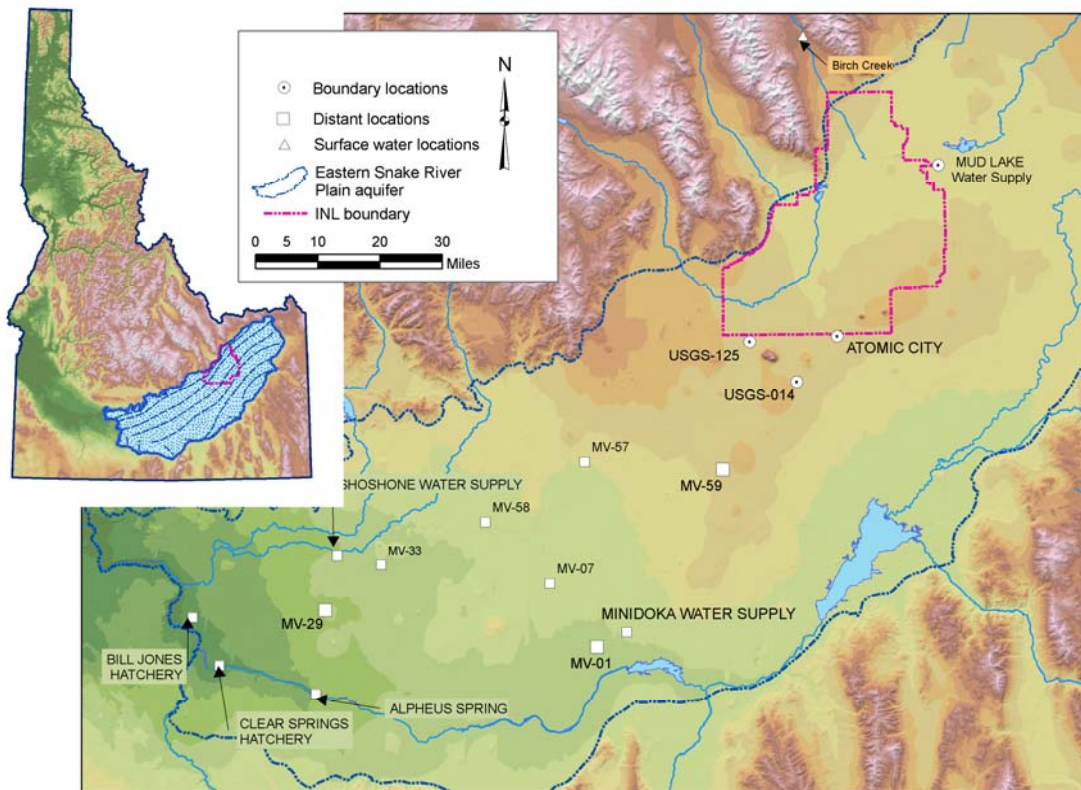


Figure 3. Boundary and distant water monitoring locations for fourth quarter, 2005.

Table 9. Alpha, beta, and gamma concentrations¹ for water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Man-made gamma-emitting radionuclide Cesium-137
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration
On-Site Locations						
ANL-MON-A-014	11/21/2005	1.1 U	2.1	2.6	1.0	<MDC
ARA-MON-A-004	12/6/2005	6.1	2.0	-0.4 U	1.1	<MDC
CFA-MON-A-002	10/4/2005	6.1	2.6	6.2	1.1	<MDC
Highway 3	10/18/2005	2.9	1.9	3.0	1.1	<MDC
ICPP-MON-A-166	10/4/2005	1.0 U	1.7	3.2	0.9	<MDC
M1S	11/15/2005	1.2 U	2.1	2.5	1.1	<MDC
M3S	11/15/2005	2.1 U	2.4	3.9	1.1	<MDC
PBF-MON-A-003	12/6/2005	4.6	1.9	3.6	1.0	<MDC
RWMC Production	10/13/2005	1.2 U	1.9	3.4	1.1	<MDC
Site-14	10/18/2005	2.1 U	1.6	3.7	0.9	<MDC
TAN-10A	10/11/2005	10.4	3.3	220.1	3.7	<MDC
TAN-13A	10/11/2005	4.2	1.7	3.4	0.9	<MDC
TRA-07	10/27/2005	7.7	2.6	5.3	1.1	<MDC
USGS-055	10/27/2005	1.4 U	1.3	39.5	1.6	<MDC
USGS-104	10/5/2005	6.8	2.0	3.1	1.0	<MDC
USGS-112	10/12/2005	6.6	2.3	31.5	1.6	<MDC
USGS-115	10/12/2005	3.0	1.9	4.6	1.0	<MDC
Effluent locations						
NRF Ind. Waste Ditch	10/24/2005	4.5	2.6	134.8	2.9	<MDC
NRF Sewage Lagoon	10/24/2005	5.6	2.9	10.2	1.2	<MDC
Boundary Locations						
Atomic City	11/9/2005	-2.0 U	2.2	2.6	1.0	<MDC
Mud Lake Water Supply	11/9/2005	-1.4 U	1.6	3.5	1.0	<MDC
USGS-014	10/17/2005	4.2	1.9	3.0	1.0	<MDC
USGS-125	10/17/2005	4.4	1.7	3.6	0.9	<MDC
Surface water locations						
Birch Creek	10/25/2005	5.0	2.0	2.3	0.9	<MDC
Distant Locations						
Alpheus Spring	11/8/2005	2.3 U	3.4	8.1	1.3	<MDC
Bill Jones Hatchery	11/8/2005	-0.4 U	2.1	2.4	1.0	<MDC
Clear Spring Hatchery	11/8/2005	2.4 U	3.0	5.0	1.2	<MDC
Minidoka Water Supply	11/8/2005	-1.4 U	2.5	3.0	1.0	<MDC
Shoshone Water Supply	11/8/2005	2.6 U	2.3	2.8	1.0	<MDC
¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. <MDC – Less than minimum detectable concentration for analysis by gamma spectroscopy.						

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. <MDC – Less than minimum detectable concentration for analysis by gamma spectroscopy.

Table 10. Reported concentrations¹ of strontium-90 in water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Strontium-90	
		Concentration	± 2 SD
On-Site Locations			
M1S	11/15/2005	-0.12 U	0.11
M3S	11/15/2005	-0.11 U	0.11
NRF Ind. Waste Ditch	10/24/2005	-0.47 J	0.35
NRF Sewage Lagoon	10/24/2005	0.17 U	0.28
RWMC Production	10/13/2005	0.15 U	0.12
TAN-10A	10/11/2005	96.0	23.0
TRA-07	10/27/2005	-0.05 U	0.1
USGS-055	10/27/2005	71.0	17.0
USGS-104	10/5/2005	-0.13 U	0.11
USGS-112	10/12/2005	10.1	2.4
USGS-115	10/12/2005	-0.07 U	0.11
¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.			

Table 11. Reported concentrations¹ of dissolved technetium-99 in water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L. Samples were filtered.

Concentrations are expressed in pCi/L. Samples were filtered.

Sample Location	Sample Date	Technetium-99	
		Concentration	± 2 SD
On-Site Locations			
ANL-MON-A-014	11/21/2005	0 U	0.1
CFA-MON-A-002	10/4/2005	0.3	0.2
M1S	11/15/2005	0 U	0.1
M3S	11/15/2005	0.4	0.2
RWMC Production	10/13/2005	0.4	0.2
TRA-07	10/27/2005	0.3	0.2
USGS-055	10/27/2005	0.2 U	0.2
USGS-104	10/5/2005	0.2	0.1
USGS-112	10/12/2005	9.4	0.3
USGS-115	10/12/2005	1.2	0.2

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 12. Reported concentrations¹ of americium-241 in water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L. Samples were not filtered.

Concentrations are expressed in pCi/L. Samples were not filtered.				
Sample Location	Sample Date	Americium-241		
		Concentration		±2 SD
On-Site Locations				
M1S	11/15/2005	0.003	U	0.021
M3S	11/15/2005	0.006	U	0.023
¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.				

Table 13. Reported concentrations¹ of total plutonium-238, plutonium-239/240, and plutonium-241 in water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L. Samples were not filtered.

Water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L. Samples were not filtered.							
Sample Location	Sample Date	Plutonium-238		Plutonium-239/240		Plutonium-241	
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration	± 2 SD
On-Site Locations							
M1S	11/15/2005	0.002 U	0.023	0.003 U	0.023	1.1 U	2.8
M3S	11/15/2005	0 U	0.026	0 U	0.026	-1.3 U	3.0
TRA-07	10/27/2005	0.007 U	0.026	-0.001 U	0.026	1.7 U	5.1
¹ Data qualifiers: U = non-detection, J = estimate, R = rejected							

Table 14. Reported concentrations¹ of total uranium-234, uranium-235, and uranium-238 in water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Uranium-234		Uranium-235		Uranium-238	
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration	± 2 SD
On-Site Locations							
M1S	11/15/2005	0.85	0.25	0.007 U	0.058	0.36	0.15
M3S	11/15/2005	1.24	0.32	0.053 U	0.062	0.64	0.21
TRA-07	10/27/2005	2.37	0.52	0.046 U	0.061	1.32	0.35
¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.							

Table 15. Reported concentrations¹ of chlorine-36 in water samples for third and fourth quarters, 2005. Samples were not filtered.

Sample Location	Sample Date	Units	Chlorine-36	
			Concentration	±2 SD
On-Site Locations				
M1S	11/15/2005	pCi/L	2.15 U	1.45
M3S	11/15/2005	pCi/L	2.53 U	1.51
Distant Locations				
Minidoka Water Supply	8/9/2005	aCi/L ²	229.0	16.0
MV-01	7/20/2005	aCi/L ²	414.0	46.0
MV-07	7/7/2005	aCi/L ²	66.0	6.0
MV-29	7/21/2005	aCi/L ²	118.0	10.4
MV-33	7/21/2005	aCi/L ²	116.0	7.0
MV-57	7/7/2005	aCi/L ²	46.4	4.0
MV-58	8/26/2005	aCi/L ²	194.0	7.8
MV-59	8/10/2005	aCi/L ²	66.7	6.0

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.
² aCi/L = 10⁻⁶ pCi/L

Table 16. Reported concentrations¹ of iodine-129 in water samples for third quarter, 2005. Concentrations are expressed in aCi/L (10⁻⁶ pCi/L). Samples were not filtered.

Sample Location	Sample Date	Iodine-129	
		Concentration	±2 SD
Distant Locations			
Minidoka Water Supply	8/9/2005	0.14	0.05
MV-01	7/20/2005	0.85	0.11
MV-07	7/7/2005	0.12	0.033
MV-29	7/21/2005	0.33	0.05
MV-33	7/21/2005	1.24	0.13
MV-57	7/7/2005	0.14	0.023
MV-58	8/26/2005	0.31	0.023
MV-59	8/10/2005	0.14	0.037

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 17. Tritium concentrations¹ for water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L.

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Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
On-Site Locations			
ANL-MON-A-014	11/21/2005	60 U	80
ARA-MON-A-004	12/6/2005	20 U	70
CFA-MON-A-002	10/4/2005	1600	130
Highway 3	10/18/2005	80 U	80
ICPP-MON-A-166	10/4/2005	230	90
M1S	11/15/2005	-10 U	70
M3S	11/15/2005	1280	120
PBF-MON-A-003	12/6/2005	-10 U	70
RWMC Production	10/13/2005	1110	110
Site-14	10/18/2005	40 U	80
TAN-10A	10/11/2005	250	90
TAN-13A	10/11/2005	-30 U	70
TRA-07	10/27/2005	16400	340
USGS-055	10/27/2005	13260	310
USGS-104	10/5/2005	1000	120
USGS-112	10/12/2005	2310	140
USGS-115	10/12/2005	1340	120
<i>Effluent locations</i>			
NRF Ind. Waste Ditch	10/24/2005	80 U	80
NRF Sewage Lagoon	10/24/2005	10 U	80
Boundary Locations			
Atomic City	11/9/2005	0 U	80
USGS-014	10/17/2005	60 U	80
USGS-125	10/17/2005	100 U	80
Mud Lake Water Supply	11/9/2005	30 U	80
<i>Surface water locations</i>			
Birch Creek	10/25/2005	10 U	80
Distant Locations			
Bill Jones Hatchery	11/8/2005	40 U	90
Clear Spring Hatchery	11/8/2005	70 U	80
Minidoka Water Supply	11/8/2005	20 U	80
Shoshone Water Supply	11/8/2005	50 U	80

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 18. Enriched tritium concentrations¹ for water samples, fourth quarter, 2005. Concentrations are expressed in pCi/L.

expressed in pCi/L.

Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
On-Site Locations			
Highway 3	10/18/2005	45	9
Site-14	10/18/2005	2 U	7
Boundary Locations			
Atomic City	11/9/2005	11	7
Mud Lake Water Supply	11/9/2005	7 U	7
USGS-014	10/17/2005	-2 U	8
USGS-125	10/17/2005	41	9
<i>Surface water locations</i>			
Birch Creek	10/25/2005	7 U	8
Distant Locations			
Alpheus Spring	11/8/2005	44	8
Bill Jones Hatchery	11/8/2005	15	7
Clear Spring Hatchery	11/8/2005	13	8
Minidoka Water Supply	11/8/2005	9 U	7
Shoshone Water Supply	11/8/2005	25	8
Third Quarter 2005 Sample Results			
Minidoka Water Supply	8/9/2005	15	8
MV-58	8/26/2005	24	8
MV-59	8/10/2005	7 U	7
Mud Lake Water Supply	8/16/2005	5 U	7
Shoshone Water Supply	8/9/2005	28	8

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected.

Table 19. Reported metals concentrations¹ in water samples, fourth quarter, 2005. Concentrations are expressed in µg/L. Samples are dissolved (filtered) unless otherwise indicated. NR = analysis not requested.

Sample Location	Sample Date	Concentration										
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Iron	Manganese	Mercury	Selenium	Zinc
On Site Locations												
ANL-MON-A-014 (total)	11/21/2005	5	37	<1 U	<1 U	<5 U	<5 U	170	<2 U	<0.5 U	<10 U	<5 U
ARA-MON-A-004 (total)	12/6/2005	<5 U	38	<1 U	<1 U	5	<5 U	140	<2 U	<0.5 U	<10 U	14
CFA-MON-A-002 (total)	10/4/2005	<5 U	53	<1 U	2	58	<5 U	1700	43	<0.5 U	<10 U	160
ICPP-MON-A-166 (total)	10/4/2005	<5 U	51	<1 U	<1 U	8	<5 U	370	44	<0.5 U	<10 U	<5 U
Highway 3	10/18/2005	NR	50	NR	NR	<5 U	<5 U	NR	<2 U	NR	NR	<5 U
M1S	11/15/2005	<5 U	20	NR	<1 U	33	<5 U	20	<2 U	NR	<10 U	<5 U
M1S (total)	11/15/2005	<5 U	20	<1 U	<1 U	33	<5 U	40	<2 U	<0.5 U	<10 U	<5 U
M3S	11/15/2005	<5 U	41	NR	<1 U	13	<5 U	<10 U	<2 U	NR	<10 U	<5 U
M3S (total)	11/15/2005	<5 U	41	<1 U	<1 U	13	<5 U	20	<2 U	<0.5 U	<10 U	<5 U
PBF-MON-A-003 (total)	12/6/2005	<5 U	52	<1 U	<1 U	6	<5 U	20	<2 U	<0.5 U	<10 U	<5 U
RWMC Production	10/13/2005	NR	39	NR	NR	13	<5 U	NR	<2 U	NR	NR	10
Site-14	10/18/2005	NR	59	NR	NR	5	<5 U	NR	<2 U	NR	NR	<5 U
TAN-10A (total)	10/11/2005	<5 U	270	<1 U	<1 U	<5 U	<5 U	970	530	<0.5 U	<10 U	12
TAN-13A (total)	10/11/2005	<5 U	72	<1 U	<1 U	<5 U	<5 U	70	4	<0.5 U	<10 U	110
TRA-07	10/27/2005	<5 U	77	NR	<1 U	110	<5 U	<10 U	<2 U	NR	<10 U	<5 U
USGS-055	10/27/2005	6	81	NR	<1 U	73	<5 U	<10 U	<2 U	NR	<10 U	<5 U
USGS-104	10/5/2005	NR	30	NR	NR	8	<5 U	NR	<2 U	NR	NR	210
USGS-112	10/12/2005	NR	103	NR	NR	12	<5 U	NR	<2 U	NR	NR	<5 U
USGS-115	10/12/2005	NR	62	NR	NR	5	<5 U	NR	<2 U	NR	NR	610
Effluent locations												
NRF Ind. Waste Ditch (total)	10/24/2005	<25 U	3000	<5 U	<5 U	<50 U	<10 U	<100 U	300	<0.5 U	<50 U	<50 U
NRF Sewage Lagoon (total)	10/24/2005	7	65	<1 U	<1 U	5	<5 U	1100	30	<0.5 U	<10 U	70
Boundary Locations												
USGS-014	10/17/2005	<5 U	20	NR	<1 U	<5 U	<5 U	30	2	NR	<10 U	60
USGS-125	10/17/2005	NR	32	NR	NR	<5 U	<5 U	NR	13	NR	NR U	<5 U
Surface Water Locations												
Birch Creek	10/25/2005	NR	62	NR	NR	<5 U	<5 U	NR	<2 U	<5	NR	NR

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.

Table 20. Reported common ions concentrations¹ for the water samples, fourth quarter, 2005. Concentrations are expressed in mg/L. Samples are dissolved (filtered) unless otherwise indicated. NR = Analysis not requested.

discussed (filtered) unless otherwise indicated. NR = Analysis not requested.

Sample Location	Sample Date	Concentration										
		Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity ²	Silica	TDS ³	TSS ⁴
On-Site Locations												
ANL-MON-A-014	11/21/2005	41	13	19	3.5	0.817	18.9	16.6	138	NR	NR	NR
ARA-MON-A-004	12/6/2005	37	15	18	3.9	0.562	18.8	19.3	139	NR	NR	NR
CFA-MON-A-002	10/4/2005	62	24	16	4.5	0.424	60.1	28	105	NR	NR	NR
ICPP-MON-A-166	10/4/2005	37	13	10	2.7	0.461	8.16	17.1	131	25	200	11
Highway 3	10/18/2005	46	12	6	2.5	0.37	6.36	19.7	147	NR	NR	NR
M1S	11/15/2005	28	12	11	2.6	0.285	13.8	20.8	93	NR	NR	NR
M1S (total)	11/15/2005	28	12	11	2.6	NR	NR	NR	NR	NR	NR	NR
M3S (total)	11/15/2005	45	15	8.3	2.7	NR	NR	NR	NR	NR	NR	NR
M3S	11/15/2005	46	15	8.3	2.7	0.358	14.2	25	140	NR	NR	NR
PBF-MON-A-003	12/6/2005	39	15	13	2.9	0.395	14.8	23.2	133	NR	NR	NR
RWMC Production	10/13/2005	50	16	9	2.8	0.388	21.8	27.6	153	NR	NR	NR
Site-14	10/18/2005	34	13	15	3.2	0.63	9.35	23.3	129	NR	NR	NR
TAN-10A	10/11/2005	102	26	57	4.6	0.276	112	38.8	272	18	554	<5
TAN-13A	10/11/2005	42	11	5.7	2.4	0.411	4.24	14.2	137	22	167	<5
TRA-07	10/27/2005	84	20	17	3.5	0.31	20.8	158	135	NR	NR	NR
USGS-055	10/27/2005	81	22	19	3.5	0.32	20.3	136	162	NR	NR	NR
USGS-104	10/5/2005	37	14	9	2.6	0.409	13.7	20.2	122	NR	NR	NR
USGS-112	10/12/2005	54	13	25	3.3	0.403	33.7	28.9	154	NR	NR	NR
USGS-115	10/12/2005	43	13	18	4.2	0.439	48.8	23.7	103	NR	NR	NR
Effluent Locations												
NRF Ind. Waste Ditch	10/24/2005	1400	450	11500	70	<10 U	21000	<200 U	212	16.4	29000	8
NRF Sewage Lagoon	10/24/2005	17	3.5	400	30	0.58	197	104	525	38.1	1200	121
Boundary												
USGS-014	10/17/2005	38	15	17	3.0	1.09	21.9	21.7	135	NR	NR	NR
USGS-125	10/17/2005	38	15	12	2.9	0.42	12.3	23.8	142	NR	NR	NR
Surface Water Location												
Birch Creek	10/25/2005	45	15	5.4	1.01	0.24	4.88	23.9	149	NR	NR	NR

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.
 ² As CaCO₃.
 ³ Dissolved nitrate + nitrite as N.
 ⁴ Dissolved phosphorus as P.

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.

² As CaCO₃.

³ Dissolved nitrate + nitrite as N.

⁴ Dissolved phosphorus as P.

Table 21. Total nutrient concentrations¹ of unfiltered water samples collected for verification purposes during the fourth quarter, 2005. Concentrations are expressed in mg/L. NR = Analysis not requested.

Sample Location	Sample Date	Concentration				
		Nitrite + Nitrate	Ammonia	Total Kjeldahl Nitrogen	Nitrite	Phosphorous
Wastewater						
ANL-MON-A-014	11/21/2005	1.92	NR	NR	NR	0.018
ARA-MON-A-004	12/6/2005	1.36	NR	NR	NR	0.017
CFA-MON-A-002	10/4/2005	16.5	NR	<0.05	NR	0.095
ICPP-MON-A-166	10/4/2005	0.233	NR	<0.05	NR	0.037
Highway 3	10/18/2005	0.418	NR	NR	NR	0.021
M1S	11/15/2005	1.09	NR	NR	NR	0.02
M3S	11/15/2005	0.853	NR	NR	NR	0.02
PBF-MON-A-003	12/6/2005	0.748	NR	NR	NR	0.02
RWMC Production	10/13/2005	0.922	NR	NR	NR	0.018
Site-14	10/18/2005	0.602	NR	NR	NR	0.015
TAN-10A	10/11/2005	0.007	<0.005	0.06	NR	0.084
TAN-13A	10/11/2005	0.416	<0.005	<0.05	NR	0.026
TRA-07	10/27/2005	468.0	NR	NR	NR	0.036
USGS-055	10/27/2005	3.32	NR	NR	NR	0.3
USGS-104	10/5/2005	0.828	NR	NR	NR	0.018
USGS-112	10/12/2005	1.57	NR	NR	NR	0.011
USGS-115	10/12/2005	1.69	NR	NR	NR	0.03
Effluent Locations						
NRF Ind. Waste Ditch	10/24/2005	0.187	NR	0.65	NR	1.27
NRF Sewage Lagoon	10/24/2005	0.026	NR	21	NR	7.44
Boundary						
USGS-014	10/17/2005	1.2	NR	NR	NR	0.013
USGS-125	10/17/2005	0.583	NR	NR	NR	0.013
Surface Water Locations						
Birch Creek	10/25/2005	0.265	NR	NR	NR	0.008

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration

¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration

Table 22. Volatile organic compound (VOC) concentrations¹ for water samples, fourth quarter, 2005. Concentrations are expressed in µg/L.

Sample Site/Analyte	Result	DL	MCL
M3S			
Carbon Tetrachloride	4.00 J	0.5	5
Trichloroethylene	0.94 J	0.07	5
¹ Data qualifiers: U = non-detection, J = estimate, R = rejected. DL – Detection Limit. NA – Not Applicable.			

Terrestrial Monitoring Results

The ESP conducts terrestrial (soil and milk) monitoring and verification to provide an indication as to the long-term deposition and migration of contaminants in the environment, and to provide independent verification of DOE's analytical measurement of terrestrial variables.

Results for analyses of milk samples, which are collected monthly, are presented in **Table 23**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131, a man-made radionuclide, was not detected.

DEQ-INL monitors long-term radiological conditions using measurement devices capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides insight to the transport, deposition, and accumulation of radioactive material in the environment as a result of INL operations and the historic atmospheric testing of nuclear weapons.

Concentrations of man-made radionuclides were monitored at eight soil sampling locations used by INL near operating facilities. A duplicate measurement performed at location identified as NRF-14 met duplicate measurement acceptance criteria. DEQ-INL routinely monitors concentrations of man-made and naturally occurring radionuclides in soil via *in-situ* gamma spectroscopy at a fraction of the monitoring locations used by INL contractors on an annual basis. No man made radionuclides were identified other than cesium-137 which was found in concentrations consistent with historical, above-ground testing of nuclear weapons (**Table 24**). An estimated measurement of americium-241 near the MDC was observed at a soil monitoring location near the Materials and Fuel Complex (the former ANL-West facility) with a concentration of 0.73 ± 0.52 pCi g⁻¹ (estimated MDC: 0.82 pCi g⁻¹).

Table 23. Gamma spectroscopy analysis data for milk samples, fourth quarter, 2005. Concentrations are expressed in pCi/L.

are expressed in pCi/L.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40		Man-made gamma-emitting radionuclide Iodine-131 ¹
		Concentration	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	10/11/05	1413	109	<MDC
	11/08/05	1369	108	<MDC
	12/09/05	1502	102	<MDC
Mud Lake/Nelson-Ricks Creamery	10/11/05	1426	113	<MDC
	11/08/05	1506	102	<MDC
	12/09/05	1508	113	<MDC
Rupert-Minidoka/Kraft	10/11/05	1473	100	<MDC
	11/08/05	1506	113	<MDC
	12/06/05	1487	112	<MDC
Gooding/Glanbia	10/11/05	1412	113	<MDC
	11/08/05	1288	106	<MDC
	12/06/05	1484	100	<MDC
Verification Samples²				
Blackfoot	11/01/05	1279	105	<MDC
Idaho Falls	11/01/05	1560	104	<MDC
Moreland	10/04/05	1442	114	<MDC
Roberts	10/04/05	1596	105	<MDC
Rupert	12/06/05	1459	111	<MDC
Terreton	12/06/05	1401	111	<MDC

¹ <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).

² DEQ-INL samples collected by the off-site INL environmental surveillance contractor.

Table 24. In-Situ gamma spectroscopic analysis results for soil monitoring conducted during the fourth calendar quarter of 2005 at facility soil sampling grid locations maintained by INL. Concentrations are expressed in pCi g⁻¹ ± 2-sigma counting uncertainty propagated with an estimated 10 percent systematic sampling uncertainty.

Location	Date Acquired	Cesium-137	MDC	Potassium-40	MDC
Naval Reactors Facility – Soil Sampling Grid Locations					
NRF-6	10/25/05	1.13 ± 0.24	0.14	23.6 ± 4.8	1.57
NRF-7	10/25/05	0.51 ± 0.12	0.11	23.2 ± 4.7	1.57
NRF-8	10/25/05	0.59 ± 0.14	0.12	21.1 ± 4.3	1.52
NRF-12	10/25/05	0.36 ± 0.10	0.11	21.3 ± 4.4	1.52
NRF-14	10/25/05	0.73 ± 0.16	0.12	22.3 ± 4.6	1.54
Materials and Fuel Complex – Soil Sampling Grid Locations					
EBR-II-3	10/26/05	0.64 ± 0.15	0.11	21.1 ± 4.3	1.49
EBR-II-4	10/26/05	0.44 ± 0.11	0.10	19.7 ± 4.0	1.43
EBR-II-5	10/26/05	0.65 ± 0.15	0.11	19.2 ± 3.9	1.41

Quality Assurance

The measurement of any physical quantity is subject to uncertainty from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While the sum of these inaccuracies cannot be quantified for each analytical result, a quality assurance program can evaluate the overall quality of a data set and possibly identify and address errors or inaccuracies.

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the fourth quarter of 2005 for the DEQ-INL's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for nonradiological analyses and to Idaho State University's Environmental Monitoring Laboratory (ISU-EML) for radiological analyses during the quarter. All analyses and QC measures at the analytical laboratories used by the ESP are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the fourth quarter of 2005, the DEQ-INL submitted 88 QC samples for various radiological and nonradiological analyses (**Table 25**).

Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or unmeasurable amounts of the analyte(s) of interest in them. They are designed to determine if analyses will provide a "zero" result when no contaminant is expected to be present or an acceptable measure of "background," and therefore monitor any bias that may have been introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the fourth quarter of 2005 are presented in **Table 26**. Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 27**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 28**. Blank sample results for metals in groundwater can be found in **Table 29**. Blank analyses results for cesium-137, potassium-40, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water media are presented in **Table 30**. Nutrient and common ion blank results in groundwater are listed in **Table 31**.

One anomaly was observed in the results of the fourth quarter 2005 tritium water vapor blank. A detectable level of tritium was found in one split blank sample. Currently, it is suspected that, during preparation at DEQ-INL, the blank sample was cross contaminated with a water vapor sample from the INL that routinely contains small amounts of tritium from INL operations. This result is currently under investigation and will be closely followed in the future.

No other anomalies were observed from the assessment of field blank samples as measured by the analytical laboratories used by DEQ-INL for the fourth quarter of 2005.

Duplicate Samples

Duplicate samples are collected in a manner such that the samples are thought to be essentially identical in composition and are used to assess analytical precision. The difference between the original sample and the duplicate sample is expressed as a relative percent difference (RPD) and is used to measure a laboratory's ability to reproduce consistent results. For radiological analyses, the standard deviation of the differences can be used as an indicator of the overall precision of the data set. Duplicate results for ground and surface water are presented in **Table 32** for radiological analyses and **Tables 33 and 34** for non-radiological analyses. Duplicate results for in-situ radiological soil measurements are found in **Table 35**.

No anomalies were observed from the assessment of field duplicate samples as measured by the analytical laboratories used by DEQ-INL for the fourth quarter of 2005.

Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added in order to assess the bias a laboratory may have in accurately measuring these analytes. To determine agreement after laboratory analysis, DEQ-INL calculates the difference between the known concentration in the sample and the measured concentration by the laboratory. This result is known as percent recovery (%R) and the acceptable range used by DEQ-INL is 100 ± 25 percent. During fourth quarter 2005, no field matrices were spiked to assess the influence of the sample media on laboratory performance. However, several spiked samples were created using de-ionized water and submitted to analytical laboratories for analyses. These non-radiological constituents used to assess groundwater analyte recovery rates are presented in **Tables 36, 37 and 38**.

DEQ-INL also prepares additional "spike-like" quality control samples to assess ambient radiation measurement bias. Once per quarter, DEQ-INL irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and a "blind" exposure ranging from 20 to 50 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by ISU-EML. EIC response is considered acceptable if each measurement agrees within 25 percent of the known irradiated quantity. The irradiation results for fourth quarter 2005 are presented in **Table 39**. One value exceeded the control limit. This pattern of biased high spike results has been seen in the past and is currently under investigation by DEQ-INL in cooperation with the vendor (RadElect) and ISU-EML. Results of the investigation are expected to be included in the first quarter 2006 data report.

No additional anomalies other than those listed above were observed from the assessment of spiked samples as measured by DEQ-INL or the analytical laboratories used by DEQ-INL for the fourth quarter of 2005.

Analytical QA/QC Assessment

No issues involving sample chain of custody, sample holding times, the analysis of blank, and duplicate samples were observed during the fourth quarter of 2005 which significantly affected data quality. Methodologies and data reports issued by the contracting laboratories generally conformed to the requirements of DEQ-INL during the fourth quarter of 2005.

Data usability is the measure of data that is not rejected compared to the amount that was expected to be obtained. The overall data usability rate for the fourth quarter of 2005 met the minimum criteria of the DEQ-INL ESP and is summarized in **Table 26**.

Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the fourth quarter of 2005 is summarized in **Table 40**. No air sampling equipment required repair during the fourth quarter. However, the precipitation sample collection equipment at Howe was suspended for a portion of the fourth quarter sample period (70%) because of irrigation water interference.

Conclusion

All data collected for the fourth quarter of 2005 have been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data has been verified and deemed complete with the exception of three samples outstanding, meeting the requirements and data quality objectives established by DEQ-INL.

Table 25. Summary of the analytical performance and usability of the analyses performed for the DEQ-INL ESP for fourth quarter, 2005.

Media Sampled	Collection Device	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses	Data Rejected ¹	Analyzing Lab ²
AIR								
Particulate	4 inch filter	Gross alpha	141	13	0	0	0	ISU-EML
		Gross beta	141	13	0	0	0	ISU-EML
		Gamma emitters	11	1	0	0	0	ISU-EML
		Radiochemical	0	0	0	0	0	ISU Sub
Particulate	Desiccant column	Tritium	31	4	0	0	0	ISU-EML
Gaseous	Charcoal filter	Iodine-131	13	0	0	0	0	ISU-EML
Precipitation	Poly bottle	Tritium	6	0	0	0	0	ISU-EML
		Gamma emitters	6	0	0	0	0	ISU-EML
WATER								
Groundwater & Surface Water	Grab or composite	Gross alpha	29	3	2	0	0	ISU-EML
		Gross beta	29	3	2	0	0	ISU-EML
		Gamma emitters	29	3	2	0	0	ISU-EML
		Tritium	29	3	2	0	0	ISU-EML
		Enriched tritium ³	18	3	2	0	0	ISU-EML
		Technetium-99	10	0	0	0	0	ISU-EML
		Radiochemical	17	0	0	0	0	ISU Sub
		Metals	24	3	1	2	0	IBL
		Common Ions	22	3	1	2	0	IBL
		Nutrients	22	3	1	2	0	IBL
Volatile Organics	4	0	0	2	0	IBL Sub		
TERRESTRIAL								
Milk	Grab or composite	Gamma emitters	18	0	0	0	0	ISU-EML
Soil	<i>in situ</i>	Gamma emitters	8	0	1	0	0	DEQ-INL
	Grab – “puck”	Gamma emitters	0	0	0	0	0	ISU-EML
RADIATION								
Ambient	EICs	Gamma Radiation	91	4	0	7	0	DEQ-INL
	HPICs	Gamma Radiation	NA	NA	NA	NA	NA	DEQ-INL
Total Analyses			699	59	14	15	0	
Total of QC Analyses (blanks, duplicates, and spikes)						88		
Percentage of QC analyses of total analyses ⁴						12.6		
Percentage of usable data ⁵						100		
¹ Combined Laboratory and DEQ-INL rejection criteria (data was rejected for any reason).								
² ISU-EML = Idaho State University – Environmental Monitoring Laboratory; ISU Sub = Subcontract laboratory to ISU-EML; IBL = Idaho Bureau of Laboratories, Boise; IBL Sub = Subcontract laboratory to IBL; DEQ-INL = Analyzed by INEEL Oversight and Radiation Control, Idaho Department of Environmental Quality.								
³ Seven enriched tritium analyses (including one blank) were delayed from the 3 rd quarter and are combined with the 4 th quarter results.								
⁴ Analyzing quality control samples at a rate of approximately 5 to 10 percent of the total number of analyses performed for the year is deemed appropriate for the DEQ-INL ESP.								
⁵ Data usability rate [total analyses – rejected data]/[total analyses] of 90 percent or higher is acceptable for the DEQ-INL ESP.								

Table 26. Blank analysis results for gross alpha and beta in particulate air (TSP) for the fourth quarter, 2005. Concentrations¹ and associated uncertainties (2 SD) are expressed in 1×10^{-3} pCi/m³.

Collection Period		Corrected volume (m ³) ¹	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty (± 2 SD)	Value	Uncertainty (± 2 SD)
09/29/05	10/06/05	1735	0.0	0.2	-0.2	0.3
10/06/05	10/13/05	1735	0.4	0.3	-0.3	0.5
10/13/05	10/20/05	1735	0.2	0.2	-0.3	0.3
10/20/05	10/27/05	1735	0.2	0.2	0.0	0.3
10/27/05	11/03/05	1735	0.2	0.2	0.1	0.3
11/03/05	11/10/05	1735	-0.1	0.2	-0.2	0.3
11/10/05	11/17/05	1735	0.0	0.2	-0.3	0.3
11/17/05	11/23/05	1735	-0.2	0.2	0.0	0.3
11/23/05	12/01/05	1735	-0.2	0.2	0.1	0.3
12/01/05	12/08/05	1735	-0.2	0.2	-0.1	0.3
12/08/05	12/15/05	1735	-0.2	0.2	0.2	0.3
12/15/05	12/22/05	1735	-0.1	0.2	-0.1	0.3
12/22/05	12/29/05	1735	-0.1	0.2	-0.2	0.3

¹ A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.

Table 27. Blank analysis results for gamma spectroscopy for TSP particulate air filters for the fourth quarter, 2005. Concentrations¹ are expressed in 1×10^{-5} pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Beryllium-7			Ruthenium-106/ Rhodium-106			Antimony-125		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
01/30/06	-49	74	126	4	48	81	2	13	22

¹ These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. NR = analysis not requested.

Table 27 continued. Blank analysis results for gamma spectroscopy for TSP particulate air filters for the fourth quarter, 2005. Concentrations¹ are expressed in 1×10^{-5} pCi/m³ with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Analysis Date	Cesium-134			Cesium-137		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
01/30/06	-3	5	6	0	4	7

¹ These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

Table 28. Blank analysis results for tritium water vapor from air samples for the fourth quarter, 2005. Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC).

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	± 2 SD	MDC
OP054ZTR01	11/23/05	11/23/05	01/30/06	-0.04	0.08	0.13
OP054ZTR02	12/30/05	12/30/05	01/30/06	-0.02	0.08	0.14
OP054ZTR03	12/30/05	12/30/05	01/30/06	0.24	0.09	0.13
3Q05 Sink	07/26/05	12/30/05	01/30/06	0.01	0.08	0.13

Table 29. Blank analysis results (in mg/L) for metals in ground and surface water for the fourth quarter, 2005. NR = Analysis not requested.

Sample Number	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
054W106	10/18/05	NR	NR	NR	<0.002	NR	NR	<0.005	NR	NR
054W111	10/27/05	NR	NR	NR	<0.002	NR	NR	<0.005	NR	NR
05VG349	11/21/05	<0.1	<0.005	<0.005	<0.002	<0.001	<0.001	<0.005	<0.01	<0.01

Table 29, continued. Blank analysis results (in mg/L) for metals in ground and surface water for the fourth quarter, 2005. NR = Analysis not requested.

Sample Number	Sample Date	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
054W106	10/18/05	NR	<0.005	<0.002	NR	NR	NR	NR	NR	<0.005
054W111	10/27/05	NR	<0.005	<0.002	NR	NR	NR	NR	NR	<0.005
05VG349	11/21/05	<0.01	<0.005	<0.002	<0.0005	<0.01	<0.01	<0.001	<0.0015	<0.005

Table 30. Blank analysis results for cesium-137, potassium-40, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water samples for the fourth quarter, 2005. Concentrations are expressed in pCi/L with associated uncertainty (± 2 SD) and minimum detectable concentration (MDC). NR = Analysis not requested.

Sample Number	Cesium-137			Potassium-40			Tritium			Enriched Tritium			Gross Alpha			Gross Beta		
	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC	Concentration	± 2 SD	MDC
053W050	NR	-	-	NR	-	-	40 ¹	70 ¹	120 ¹	25 ²	7 ²	11 ²	NR	-	-	NR	-	-
054W103	-0.2	1.3	2.4	-41	46	80	NR	-	-	NR	-	-	0.6	0.6	0.9	-0.2	0.7	1.3
054W104	NR	-	-	NR	-	-	110	80	130	35	8	12	NR	-	-	NR	-	-
054W108	0.9	1.4	2.4	2	47	79	NR	-	-	NR	-	-	0.5	0.5	0.8	1.4	0.7	1.2
054W109	NR	-	-	NR	-	-	0	80	140	27	8	12	NR	-	-	NR	-	-
05VG351	NR	-	-	NR	-	-	40	80	130	NR	-	-	NR	-	-	NR	-	-
05VG353	0.6	1.5	2.5	-20	46	80	NR	-	-	NR	-	-	-1.2	0.7	1.4	-0.7	-0.8	1.4

¹ Previously reported in the 2nd quarter 2005 report.² This result was not completed for the 3rd quarter report and is reported here with the 4th quarter data.

Table 31. Blank analysis results (in mg/L) for common ion and nutrients in ground and surface water for the fourth quarter, 2005.

Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity as CaCO ₃	Total Nitrogen	Total Phosphorus
054W105, 106, 107	10/18/05	<0.1	<0.1	<0.1	<0.1	<0.1	<2	<2	<1	<0.005	<0.005
054W110, 111, 112	10/27/05	<0.1	<0.1	<0.1	<0.1	<0.1	<2	<2	<1	<0.005	0.006
05VG349, 350, 352	11/21/05	<0.1	<0.1	<0.1	<0.1	<0.1	<2	<2	1	<0.005	<0.005

Table 32. Duplicate radiological analysis results (in pCi/L) for ground and surface water, fourth quarter, 2005.

Analysis/ Sample Location	Original Sample Number	Analysis Date	Concentration	± 2 SD	Duplicate Sample Number	Analysis Date	Concentration	± 2 SD	/R ₁ -R ₂ /	3(s ₁ ² +s ₂ ²) ^{1/2}	Within Criteria? ¹
Gross Alpha											
Minidoka Water Supply	054W009	12/14/05	-1.4	2.5	054W015	12/12/05	0.6	2.6	2	10.8	Yes
Highway 3	054W037	10/25/05	2.9	1.9	054W082	10/28/05	1.8	2.7	1.1	9.9	Yes
Gross Beta											
Minidoka Water Supply	054W009	12/14/05	3.0	1.0	054W015	12/12/05	3.9	1.1	0.9	4.5	Yes
Highway 3	054W037	10/25/05	3.0	1.1	054W082	10/28/05	2.9	0.9	0.1	4.3	Yes
Gamma Spectroscopy Cesium-137											
Minidoka Water Supply	054W009	12/02/05	-1.1	1.4	054W015	12/07/05	-0.2	1.7	0.9	6.6	Yes
Highway 3	054W037	10/21/05	-0.2	1.5	054W082	10/25/05	-0.4	1.5	0.2	6.4	Yes
Gamma Spectroscopy Potassium-40											
Minidoka Water Supply	054W009	12/14/05	22	43	054W015	12/12/05	-24	41	46	178.2	Yes
Highway 3	054W037	10/25/05	0	48	054W082	10/28/05	30	42	30	191.3	Yes
Tritium											
Minidoka Water Supply	054W010	12/15/05	0.02	0.08	054W016	01/03/06	0.02	0.07	0.0	0.3	Yes
Highway 3	054W038	12/01/05	0.08	0.08	054W083	12/01/05	0.14	0.08	0.06	0.3	Yes
Enriched Tritium											
Minidoka Water Supply	054W009	02/03/06	9	7	054W015	02/03/06	19	8	10	31.9	Yes
Highway 3	054W037	01/06/06	45	9	054W082	01/06/06	60	9	15	38.2	Yes
¹ /R ₁ -R ₂ / ≤ 3(s ₁ ² +s ₂ ²) ^{1/2}											

Table 33. Duplicate results (in µg/L) for metals in ground and/or surface water for the fourth quarter, 2005. Relative percent difference (RPD) is acceptable at < 20 percent. Data are presented in the table in the format of "original result/duplicate result (RPD)." NR = Analysis not requested.

Sample Location	Sample Number	Duplicate Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper
Highway 3	054W040	054W084	NR	NR	NR	50/50 (0)	NR	NR	<5/<5 (0)	NR	NR

Table 33, continued. Duplicate results (in µg/L) for metals in ground and/or surface water for the fourth quarter, 2005. Relative percent difference (RPD) is acceptable at < 20 percent. Data are presented in the table in the format of "original result/duplicate result (RPD)." NR = Analysis not requested.

Sample Location	Sample Number	Duplicate Sample Number	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Highway 3	054W040	054W084	NR	<5/<5 (0)	<2/<2 (0)	NR	NR	NR	NR	NR	140/130 (7)

Table 34. Duplicate results (in mg/L) for common ions and nutrients in ground and/or surface water for the fourth quarter, 2005. Relative percent difference (RPD) is acceptable at < 20 percent. Data are presented in the table in the format of "original result/duplicate result (RPD)."

Sample Location	Sample Number	Duplicate Sample Number	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity as CaCO ₃	Total Nitrogen	Total Phosphorus
Highway 3	054W039, 040, 041	054W084, 085, 086	46/47 (2)	12/12 (0)	6/5.9 (2)	2.5/2.5 (0)	0.37/0.39 (5)	6.36/6.27 (1)	19.7/19.9 (1)	147/145 (1)	0.418/0.416 (0.3)	0.021/0.021 (0)
¹ Since the result(s) was less than five times the MDL (0.1 mg/L), the duplicate result for this analyte was acceptable at ± MDL.												

Table 35. Duplicate *in-situ* radiological measurement results (in $\mu\text{R}/\text{hour}$) for soil, collected fourth quarter, 2005. Relative percent difference (RPD) is acceptable at < 20 percent.

Sample Location	Analysis Date	Estimated Exposure	Duplicate Sample Location	Analysis Date	Estimated Exposure	RPD
NRF-14 Soil Grid at post marked RESL-14	10/25/05	13.9	NRF-14 Soil Grid at post marked RESL-14	10/25/05	13.7	1.0

Table 36. De-ionized water spike results (in $\mu\text{g}/\text{L}$) for metals in ground and surface water for the fourth quarter, 2005. A percent recovery of 100 ± 25 is considered acceptable and is recorded in parentheses (%R).

Spike Sample Number	Sample Date	Barium	Chromium	Lead	Manganese	Zinc
		Reference Spike Concentration				
		38.3	44.2	1.9	4.6	121
054W098	11/21/05	38 (99)	44 (100)	<5 (100)	5 (109)	120 (99)
		Reference Spike Concentration				
		42.0	48.5	2.1	5.0	133
05VG356	11/16/05	41 (98)	49 (101)	<5 (100)	5 (100)	140 (105)

Table 37. De-ionized water spike results (in mg/L) for common ions and nutrients in ground and surface water for the fourth quarter, 2005. A percent recovery of 100 ± 25 is considered acceptable and is recorded in parentheses (%R). All results associated with the QC samples are qualified as “estimates (J)” at a recovery of 50-74% or 126-150% if each result is greater than IDL. All results associated with the QC samples are qualified as “rejected (R)” at a recovery of <50% or >150% if each result is greater than IDL.

Spike Sample Number	Sample Date	Calcium	Magnesium	Sodium	Potassium	Fluoride	Chloride	Sulfate	Total Alkalinity as CaCO ₃	Total Nitrogen	Total Phosphorus
		Reference Spike Concentration									
		12.3	6.3	12.4	2.36	0.635	23.0	4.47	19.4	1.58	0.0187
054W097, 098, & 099	11/21/05	11 (89)	5.7 (90)	12 (97)	2.2 (93)	0.58 (91)	22.3 (97)	4.45 (99)	18 (93)	1.61 (102)	0.021 (112)
		Reference Spike Concentration									
		11.2	5.75	11.3	2.16	1.17	46.0	16.9	34.4	3.71	0.0282
05VG355, 356, 357	11/16/05	13 (116)	6.3 (110)	13 (115)	2.5 (116)	1.12 (96)	46 (100)	16.1 (95)	34 (99)	3.81 (103)	0.032 (113)

Table 38. De-ionized water spike results (in µg/L) for select VOCs in ground and surface water for the fourth quarter, 2005. A percent recovery of 100 ± 25 is considered acceptable and is recorded in parentheses (%R).

Spike Sample Number	Sample Date	Methylene Chloride	Styrene	Tetrachloroethylene	1,1,1-Trichloroethane	Chloroform
		Reference Spike Concentration				
		11.3	18.3	9.00	15.3	17.9
05VG354	11/16/05	10 (88)	18 (98)	9.2 (102)	17 (111)	18 (101)
05VG358	11/16/05	10 (88)	17 (93)	8.9 (99)	17 (111)	17 (95)

Table 39. Electret ionization chamber irradiation results (categorized as spiked samples) for fourth quarter, 2005. A percent recovery (%R) of 100 ± 25 is considered acceptable.

Electret #	Exposure Received		Gross Measured Exposure		Background ¹		Net Exposure ²		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty ³ (mR)	
S1	30.0	1.50	34.02	1.39	0.2	0.68	33.83	1.55	113%
S2	30.0	1.50	39.35	1.27	0.2	0.68	39.17	1.44	131%
S3	30.0	1.50	Sample Failure ⁴		-	-	-	-	-
S4	30.0	1.50	35.59	1.38	0.2	0.68	35.40	1.53	118%
S5	38.0	1.90	44.11	1.40	0.2	0.68	43.92	1.55	116%
S6	38.0	1.90	44.93	1.39	0.2	0.68	44.74	1.55	118%
S7	38.0	1.90	45.43	1.40	0.2	0.68	45.25	1.55	119%
S8	38.0	1.90	42.02	1.39	0.2	0.68	41.84	1.54	110%

¹ Four EICs were used for control measurements (counted as blanks) and were not irradiated. Background exposure ± 1 SD, as measured by the control group, was 0.2 ± 0.68 mR.
² [Gross Measured Exposure] – [Background].
³ Total propagated error.
⁴ Sample electret was inadvertently discharged and rendered unusable.

Table 40. Air sampling field equipment service reliability (percent operational) for fourth quarter 2005. These values were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.

Station Locations	Sample Type ¹			
	TSP	Radioiodine	Atmospheric Moisture	Precipitation
Onsite Locations				
Big Lost River Rest Area	100%	100%	100%	100%
Experimental Field Station	100%	100%	100%	NC
Sand Dunes Tower	100%	100%	100%	NC
Van Buren Avenue	100%	100%	100%	NC
Boundary Locations				
Atomic City	100%	100%	100%	100%
Howe	100%	100%	100%	30% ²
Monteview	100%	100%	100%	100%
Mud Lake	100%	100%	100%	100%
Distant Locations				
Craters of the Moon	100%	100%	100%	NC
Idaho Falls	100%	100%	100%	100%
¹ NC = sample not collected at this location ² Reduced sample collection because of agricultural irrigation interference.				

Appendix A

Table A-1. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2005.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Rest Area	09/29/05	10/06/05	1.6	0.3	33.4	1.3
	10/06/05	10/13/05	1.1	0.3	36.5	1.4
	10/13/05	10/20/05	1.3	0.3	40.4	1.4
	10/20/05	10/27/05	0.7	0.3	43.4	1.4
	10/27/05	11/03/05	0.6	0.3	27.7	1.2
	11/03/05	11/10/05	0.6	0.3	16.1	0.9
	11/10/05	11/17/05	1.0	0.3	26.7	1.2
	11/17/05	11/23/05	0.9	0.4	60.3	1.8
	11/23/05	12/01/05	0.9	0.3	43.9	1.4
	12/01/05	12/08/05	0.4	0.3	18.9	1.0
	12/08/05	12/15/05	1.5	0.3	74.4	1.9
	12/15/05	12/22/05	0.8	0.3	65.7	1.8
	12/22/05	12/29/05	0.2	0.2	18.9	1.0
Experimental Field Station	09/29/05	10/06/05	1.4	0.3	32.0	1.3
	10/06/05	10/13/05	0.7	0.3	32.9	1.3
	10/13/05	10/20/05	1.6	0.3	32.1	1.3
	10/20/05	10/27/05	1.5	0.4	47.6	1.6
	10/27/05	11/03/05	0.8	0.3	28.0	1.2
	11/03/05	11/10/05	0.8	0.3	15.5	0.9
	11/10/05	11/17/05	0.7	0.3	24.7	1.2
	11/17/05	11/23/05	1.3	0.4	67.2	2.0
	11/23/05	12/01/05	1.4	0.3	45.3	1.4
	12/01/05	12/08/05	0.4	0.3	22.1	1.1
	12/08/05	12/15/05	1.5	0.3	89.4	2.1
	12/15/05	12/22/05	1.7	0.4	82.1	2.0
	12/22/05	12/29/05	0.1	0.2	18.1	1.0

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2005.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes	09/29/05	10/06/05	1.1	0.3	30.4	1.2
	10/06/05	10/13/05	1.0	0.3	28.9	1.2
	10/13/05	10/20/05	1.5	0.3	36.6	1.3
	10/20/05	10/27/05	1.2	0.3	42.4	1.4
	10/27/05	11/03/05	1.1	0.3	25.7	1.1
	11/03/05	11/10/05	0.6	0.2	16.0	0.9
	11/10/05	11/17/05	1.1	0.3	27.5	1.2
	11/17/05	11/23/05	1.2	0.5	61.2	2.3
	11/23/05	12/01/05	1.2	0.3	43.5	1.3
	12/01/05	12/08/05	0.6	0.3	24.7	1.4
	12/08/05	12/15/05	1.8	0.3	97.8	2.1
	12/15/05	12/22/05	1.5	0.3	68.3	1.8
	12/22/05	12/29/05	0.4	0.2	20.0	1.0
Van Buren	09/29/05	10/06/05	2.0	0.4	30.0	1.3
	10/06/05	10/13/05	0.8	0.3	33.1	1.3
	10/13/05	10/20/05	1.5	0.3	37.6	1.4
	10/20/05	10/27/05	1.2	0.3	39.5	1.4
	10/27/05	11/03/05	0.9	0.3	27.7	1.2
	11/03/05	11/10/05	0.8	0.3	17.9	1.0
	11/10/05	11/17/05	1.3	0.3	26.3	1.2
	11/17/05	11/23/05	0.9	0.4	58.0	1.8
	11/23/05	12/01/05	0.9	0.3	43.0	1.7
	12/01/05	12/08/05	0.6	0.4	19.3	1.3
	12/08/05	12/15/05	1.3	0.3	83.6	2.0
	12/15/05	12/22/05	1.2	0.3	77.6	1.9
	12/22/05	12/29/05	0.3	0.2	19.4	1.0
Atomic City	09/29/05	10/06/05	1.0	0.3	32.3	1.3
	10/06/05	10/13/05	0.8	0.3	34.4	1.3
	10/13/05	10/20/05	1.4	0.4	39.5	1.7
	10/20/05	10/27/05	1.3	0.3	44.8	1.5
	10/27/05	11/03/05	0.6	0.3	29.5	1.2
	11/03/05	11/10/05	0.5	0.2	17.4	1.0
	11/10/05	11/17/05	1.5	0.3	28.3	1.2
	11/17/05	11/23/05	1.2	0.4	67.6	2.0
	11/23/05	12/01/05	0.9	0.3	45.8	1.4
	12/01/05	12/08/05	0.1	0.2	20.4	1.0
	12/08/05	12/15/05	1.4	0.3	96.1	2.2
	12/15/05	12/22/05	1.0	0.3	66.7	1.8
	12/22/05	12/29/05	0.4	0.2	19.5	1.0

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2005.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	09/29/05	10/06/05	NS ²		NS ²	
	10/06/05	10/13/05	0.7	0.3	25.6	1.2
	10/13/05	10/20/05	1.3	0.3	36.7	1.4
	10/20/05	10/27/05	0.9	0.3	35.4	1.4
	10/27/05	11/03/05	1.2	0.3	21.3	1.1
	11/03/05	11/10/05	1.0	0.3	14.0	0.9
	11/10/05	11/17/05	1.0	0.3	20.9	1.1
	11/17/05	11/23/05	0.9	0.5	46.4	2.0
	11/23/05	12/01/05	0.7	0.3	32.8	1.2
	12/01/05	12/08/05	0.3	0.3	16.0	0.9
	12/08/05	12/15/05	1.3	0.3	74.2	1.9
	12/15/05	12/22/05	1.1	0.3	71.5	2.0
	12/22/05	12/29/05	0.3	0.2	18.0	1.0
Montevue	09/29/05	10/06/05	1.5	0.3	29.2	1.2
	10/06/05	10/13/05	0.8	0.3	29.8	1.2
	10/13/05	10/20/05	1.7	0.3	37.9	1.4
	10/20/05	10/27/05	0.8	0.3	35.3	1.3
	10/27/05	11/03/05	0.8	0.3	25.9	1.1
	11/03/05	11/10/05	0.9	0.3	16.4	0.9
	11/10/05	11/17/05	0.7	0.3	26.0	1.1
	11/17/05	11/23/05	0.5	0.3	40.8	1.5
	11/23/05	12/01/05	0.9	0.3	38.3	1.3
	12/01/05	12/08/05	0.4	0.3	23.3	1.1
	12/08/05	12/15/05	2.1	0.4	83.2	2.4
	12/15/05	12/22/05	1.0	0.3	56.2	1.6
	12/22/05	12/29/05	0.4	0.2	18.4	1.0
Mud Lake	09/29/05	10/06/05	2.0	0.4	32.6	1.3
	10/06/05	10/13/05	0.9	0.3	29.0	1.2
	10/13/05	10/20/05	1.7	0.3	40.0	1.4
	10/20/05	10/27/05	1.3	0.3	44.1	1.4
	10/27/05	11/03/05	0.8	0.3	26.0	1.1
	11/03/05	11/10/05	0.7	0.3	14.9	0.9
	11/10/05	11/17/05	1.1	0.3	26.6	1.1
	11/17/05	11/23/05	1.1	0.4	59.5	1.8
	11/23/05	12/01/05	1.0	0.3	42.8	1.3
	12/01/05	12/08/05	0.3	0.2	22.2	1.0
	12/08/05	12/15/05	2.3	0.4	95.2	2.1
	12/15/05	12/22/05	1.5	0.4	67.4	2.1
	12/22/05	12/29/05	0.5	0.2	20.5	1.0

Table A-1 continued. Weekly concentrations (in 1×10^{-3} pCi/m³) for gross alpha and gross beta analyses for TSP filters for all locations, fourth quarter, 2005.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Distant Locations						
Craters	09/29/05	10/06/05	0.8	0.3	23.4	1.1
	10/06/05	10/13/05	0.2	0.2	28.7	1.2
	10/13/05	10/20/05	1.3	0.3	32.0	1.3
	10/20/05	10/27/05	0.9	0.3	32.4	1.3
	10/27/05	11/03/05	0.5	0.2	20.4	1.0
	11/03/05	11/10/05	0.9	0.3	10.9	1.0
	11/10/05	11/17/05	0.5	0.2	18.8	1.0
	11/17/05	11/23/05	0.5	0.3	44.9	1.6
	11/23/05	12/01/05	0.8	0.3	34.7	1.2
	12/01/05	12/08/05	0.4	0.3	12.7	0.8
	12/08/05	12/15/05	0.8	0.3	44.2	1.5
	12/15/05	12/22/05	1.3	0.3	50.3	1.6
	12/22/05	12/29/05	0.3	0.2	9.7	0.7
Fort Hall ¹	09/29/05	10/06/05	1.3	0.3	23.1	1.1
	10/06/05	10/13/05	0.9	0.3	24.8	1.1
	10/13/05	10/20/05	2.2	0.4	30.8	1.3
	10/20/05	10/27/05	2.4	0.4	28.7	1.2
	10/27/05	11/03/05	0.8	0.3	23.7	1.1
	11/03/05	11/10/05	NS ²		NS ²	
	11/10/05	11/17/05	1.0	0.3	18.5	1.0
	11/17/05	11/23/05	1.9	0.4	42.9	1.6
	11/23/05	12/01/05	0.8	0.3	22.5	1.0
	12/01/05	12/08/05	0.7	0.3	12.3	0.8
	12/08/05	12/15/05	1.3	0.3	56.4	1.7
	12/15/05	12/22/05	1.6	0.3	50.2	1.5
	12/22/05	12/29/05	1.1	0.3	11.9	0.8
Idaho Falls	09/29/05	10/06/05	1.4	0.3	24.5	1.1
	10/06/05	10/13/05	0.9	0.3	32.4	1.2
	10/13/05	10/20/05	1.8	0.4	35.5	1.6
	10/20/05	10/27/05	1.3	0.3	38.4	1.3
	10/27/05	11/03/05	0.9	0.3	25.0	1.1
	11/03/05	11/10/05	0.5	0.2	13.7	0.8
	11/10/05	11/17/05	1.1	0.3	23.6	1.0
	11/17/05	11/23/05	1.2	0.4	52.1	1.6
	11/23/05	12/01/05	0.9	0.3	37.3	1.2
	12/01/05	12/08/05	0.2	0.2	17.0	0.9
	12/08/05	12/15/05	1.4	0.3	76.0	1.8
	12/15/05	12/22/05	1.4	0.3	66.7	1.7
	12/22/05	12/29/05	0.5	0.2	14.6	0.8

¹ Operated by Shoshone-Bannock Tribes.

² No sample due to equipment failure.

Appendix B

Table B-1. Results¹ for additional electret locations, fourth quarter, 2005.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
Dubois	20.0	4.7
Hamer	22.3	1.3
Sugar City	20.4	2.7
Blue Dome	15.1	3.5
TAN	19.8	1.8
ICPP I	20.1	4.1
NRF	23.2	4.7
EBR II	19.7	3.7
TRA	20.4	7.4
Grid 3	19.8	4.3
PBF	20.2	2.5
CFA	22.6	2.1
RWMC	18.8	1.4
Roberts	21.8	1.3
Kettle Butte	17.3	4.1
Blackfoot	18.6	2.7
Taber	19.7	4.1
Aberdeen	18.0	3.0
Minidoka	15.2	1.6
Arco	NS ¹	NS ¹
Richfield	18.3	4.3
EBR I	19.7	5.0
Reno Ranch	17.0	1.6
Rover Rd. 2.9mi	17.2	2.4
Rover Rd. 4.9mi	19.4	0.4
Rover Rd. 6.3mi	17.6	5.9
Rover Rd. 6.8mi	18.6	3.6
Rover Rd. 8.8mi	17.1	1.3
Rover Rd. 10.8mi	NS ¹	NS ¹
Rover Rd. 15.4mi	23.2	7.7
Rover Rd. 17.4mi	22.0	9.4
MP1 - 22/33	19.7	4.2
MP3 - 22/33	17.4	3.9
MP5 - 22/33	17.0	1.8
MP7 - 22/33	18.4	3.6

¹ No sample, electret lost

Table B-1 continued. Results¹ for additional electret locations, fourth quarter, 2005.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
MP9 - 22/33	19.1	2.9
MP23 - 33	16.5	2.1
MP25 - 33	18.9	0.2
MP27 - 33	20.2	5.8
MP29 - 33	19.9	0.8
MP31 - 33	20.8	3.3
MP33 - 33	21.7	2.4
MP35 - 33	19.3	3.0
MP37 - 33	18.6	1.6
MP39 - 33	20.0	3.5
MP41 - 33	23.9	4.9
MP43 - 33	24.6	3.6
Mud Lake - Bank of Commerce	25.5	15.1
MP1 - Lincoln Blvd	17.7	0.8
MP5 - Lincoln Blvd	22.5	3.9
MP7 - Lincoln Blvd	23.3	3.9
MP9 - Lincoln Blvd	23.5	3.7
MP11 - Lincoln Blvd	23.9	3.7
MP13 - Lincoln Blvd	22.7	3.5
MP15 - Lincoln Blvd	22.2	1.5
MP17 - Lincoln Blvd	23.9	3.0
MP19 - Lincoln Blvd	17.9	2.2
MP21 - Lincoln Blvd	16.4	1.0
MP264 - 20	20.6	2.0
MP266 - 20	20.1	14.4
MP268 - 20	18.8	2.6
MP270 - 20	17.6	2.0
MP272 - 20	18.1	0.8
MP274 - 20	17.5	2.5
MP276 - 20	20.6	2.8
MP270 - 20/26	21.2	1.9
MP268 - 20/26	21.5	11.3
MP266 - 20/26	20.3	1.3
MP263 - 20/26	21.9	3.6
MP261 - 20/26	19.8	2.6
MP259 - 20/26	17.8	3.7
Howe Fence-line 1.4mi	16.1	5.1
¹ No sample, electret lost		

Table B-1 continued. Results¹ for additional electret locations, fourth quarter, 2005.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
Howe Fence-line 2.3mi ¹	NS	NS
Howe Fence-line 4.2mi	19.0	4.1
Howe Fence-line 6.5mi	18.7	3.3
Howe Fence-line 8.6mi	18.1	1.0
Howe Fence-line 9.7mi	18.3	3.6
Howe Met. Tower	19.3	6.4
¹ No sample, electret lost		

Appendix C

Table C-1. List of volatile organic compounds (VOCs) analyzed for water verification samples, fourth quarter, 2005. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	MDC
Benzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
1,4-Dichlorobenzene	0.5
1,2-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5
1,1-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
1,2-Dichloropropane	0.5
Ethylbenzene	0.5
Methylene Chloride	0.5
Styrene	0.5
Tetrachloroethylene (PERC)	0.5
Toluene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethylene	0.5
Vinyl chloride	0.5
Xylenes (total)	0.5
Bromodichloromethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5
Chloroform	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	0.5
tert-Butylbenzene	0.5
Chloroethane	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5
4-Chlorotoluene	0.5
1,2-Dibromo-3-chloropropane (DBCP)	1.0
1,2-Dibromoethane (EDB)	0.5

Table C-1 continued. List of volatile organic compounds (VOCs) analyzed for water verification samples, fourth quarter, 2005. Minimum detectable concentrations (MDC) are expressed in µg/L.

Analyte	MDC
Dibromomethane	0.5
1,3-Dichlorobenzene	0.5
Dichlorodifluoromethane	0.5
1,1-Dichloroethane	0.5
1,3-Dichloropropane	0.5
2,2-Dichloropropane	0.5
1,1-Dichloropropene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,3-Dichloropropene	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methyl Tert Butyl Ether (MTBE)	1.0
Naphthalene	1.0
n-Propylbenzene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,2,3-Trichlorobenzene	1.25
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	0.5
1,3,5-Trimethylbenzene	0.5